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ARTICLE XVII.

Observations to determine the horizontal Magnetic Intensity and Dip at Louisville, Kentucky, and at Cincinnati, Ohio. By John Locke, M. D., Professor of Chemistry in the Medical College of Ohio. Read May 15, 1840.

The following observations were made to determine the relative horizontal magnetic intensities at Louisville, Kentucky, and Cincinnati, Ohio. The apparatus used was that invented by Professor Bache, in which the needles are made to oscillate in a rarefied medium. Two of the needles used (Nos. 1 and 2) were of the model of those of Professor Hansteen; the third (No. 3) was flat, with lozenge points.

HORIZONTAL INTENSITY.

			Cinc	innati	, Ма	irch	7,	1840. <i>I</i>	Latitu	de 39° 06′ N.;	Longitude	34° 2'	7' W.		
No. of Needle. Co			Time imence	of ement.	Mea	n Tei	np.	Duration 500 Vibra		Calculated duration at 60°.	Square of the Time.	Observations.			
No.	1 2 3	11 ^h 11 12	10 ^m 47 36	05s.6 04.4 05.6	58	64' 00 00	F.	25.6666 25.3733 20.6160		25.6777 Min. 25.3808 20.6160	659.34428 644.18500 425.01945	do.	; sprinkl do. do.	es of rain. do. do.	
								Cincinn	ati, M	March 14, 1840.					
No.	1 2 3	12	33 ^m 16 54	59s.2 03.2 59.2	45	5' 0 5	F.	$25.6600 \\ 25.3600 \\ 20.6066$		25.6954 Min. 25.4151 20.6239	660.25358 645.92731 425.34525	Beginning to rain. Raining. do.			
		L_{c}	uisv	ille, K	y., 1	Mar	ch 1	0, 1840.	Lat	titude 38° 03' N	V.; Longitu	de 85°	30' V	V.	
No.	1 2 3	11 ^b 12 1	44 ^m 20 18	0.2s4 58.8 00.0	57	50′ 50 10	F.	25.3333 25.0200 20.3333		25.3363 Min. 25.0290 20.3368	641.77777 626.45084 413.58540	Clear; do. do.	brisk N. do. do.	W. wind. do. do.	
								Louisvi	lle, N	March 11, 1840.					
No.	1 2 3	11 ^h 12 12	40 ^m 14 48	04 ^s .8 04 03 .2	41	5′ 0	F.	$\begin{vmatrix} 25.3000 \\ 24.9733 \\ 20.3200 \end{vmatrix}$		25.3622 Min. 25.0421 20.3400	643.24119 627.10677 413.71560	do.		derate. do. do.	

By comparing these double suites of experiments made at each of the places, Cincinnati and Louisville, I obtain the following ratios of horizontal intensity:

Cincinnati, March 7th, and Louisville, March 10th, 1840.

												Lou.	Cin.
By needle	No.	1,						•				1:	0.9733
46	No.	2,										1:	0.9723
"	No.	3,	•	•	•	•	•	•	•	•	•	1:	0.9730
		Cin	cinnati	, <i>M</i> a	rch 7	th, an	d Lov	uisvill	le, Mo	arch 1	1 <i>th</i> .		
By needle	No.	1,	•									1:	0.9755
66	No.	2,	•					•	•	•		1:	0.9735
44	No.	3,	•	•	•			•	•	•		1:	0.9734
		Cine	innati,	, Ma	rch 14	th, a	nd Lo	uisvii	lle, M	arch :	10 <i>th</i> .		
By needle	No.	1,	•									1:	0.9720
46	No.	2,				•						1:	0.9698
44	No.	3,	•	•	•	•	•	•	•	•	•	1:	0.9723
		Cin	cinnati	, Ma	rch 1	1th, a	nd Lo	visvi	lle, M	larch	11 <i>th</i> .		
By needle	No	. 1,	•				•			•		1:	0.9742
"	No	. 2,	•				•	•				1:	0.9709
4.6	No	. 3,	•	•		•		•	•	•		1:	0.9726
					Me	an,						1:	0.9727

We have, then, the horizontal intensity at Louisville to that at Cincinnati as 1 to 0.9727.

MAGNETIC DIP.

Cincinnati, March 6th, 1840, 2h. 30 m., P. M. Longworth's Garden.

By needle No. 1,	•	•		•					•	70 °	27	.25
" No. 2,	•		•	•	•	•	•	•	•	70	27	.8125
			M	aan						=0	0.00	-010

Cincinnati,	Marc	h, 3h	.30m	., P.	M., a	t my	own i	house,	in th	e gar	den.
By needle No. 1,		•		•						7 0°	24'.25
" No. 2,	•		•	•	•	•	•		•	70	22 .8125
			Me	an,		•	•			70	23 .5312
M	[ean	dip at	Cinci	nnati,	, 70°	25′.5	312*				
Louis	ville,	Mar	ch 10,	8 h.	13m.	, A. I	И. Ј	acob's	woo.	ds.	
By needle No. 1,										69 °	55'.25
" No. 2,		•	•	•		•	•	•		69	51 .375
			Me	an,						69	53 .3125
Louis	ville,	Mar	ch 11,	6 h. \$	23 m.,	A. A	1. J	acob's	Wood	ds.	
By needle No. 1,										6 9°	57′
" No. 2,	•		•			•	•			69	56.7 5
			Me	an,			•	•	•	69	56 .875
	Lo	uisvil	le, Ma	rch 1	1th, 8	5 h. 2	7 m.,	P. M.			
By needle No. 1,			•						•	6 9°	55'.125
" No. 2,	•	•		•	•	•	•	•	•	· 69	53 .75
			Me	an,						69	54. 4375
M	lean (dip at	Louis	ville,	69° 5	54′.87	50.				

The relative total intensities at Louisville and Cincinnati, calculated from the preceding elements of dip and horizontal intensity at the same places, are as 1.0000: 1.0031.

The following experiments were made to determine the correction for temperature of these needles.

A stove and pipe of copper were introduced into a room in my house, fifteen feet square, and having no unusual quantity of iron about it. Opening the room on the morning of the 22d of March, the apparatus was cooled down to 38° F., and the time of five hundred vibrations observed. It was then heated as rapidly as possible by means of the copper stove to 91°.4, and the time of five hundred vibrations again observed and noted. The constant coefficient

* The dip determine	ed at L	ongwo	rth's	gard	en sin	ce th	is pe	riod,	name	ly, 2	1st of	`Apr	il, 18	40,	
was, by Needle	No. 1	, .													7 0° 2 9′. 6 8
"	No. 2	, .	٠												70 28
								TV	Tean.						70 28 84

was then deduced by Hansteen's formula. Similar experiments were made with the other needles, as below.

										Min. Sec.
March 22d,	1840.	Needle No	. 1.	Ten	nperatu	re 38°.	500	vibra	tions in	25 34.8
				Ter	nperatu	re 91.4	. "		66	$25 \ 44.8$
	Coefficient deduced,									
March 25.	Mean	temperature	37°	36 ′.	Needl	e No. 3	1. 50	00 vib	rations in	25 33.8
	Mean	temperature	91	5	46	"	4	46	"	25 44
	Coefficient deduced,									
						Me	an for	No.	1,	0.000125
March 24.	Mean	temperature	50.	ľ	Needle :	No. 2.	500	vibra	tions in	25 18.8
			86.1	2	66	"	"		66	$25\ 26.8$
					Coe	fficient	dedu	ced,		0.000145
March 25.	Mean	Temperature	e 48.	Ne	edle N	o 3.	500 v i	b ratio :	ns in	20 34.6
			90		"		66	"		20 37.6
					Coe	fficient	dedu	ced,		0.000058

This last needle, the flat one with lozenge points before referred to, seems very little affected by temperature.

It may, perhaps, excite surprise, and, possibly, some doubt as to the accuracy of my observations, that the dip given above for Cincinnati is so much less than that which I obtained in November, 1837, the latter being 70° 45′.75, and the former 70° 25′.5312; and that the dip at Louisville, August 31, 1839, should have been 70° 08′, and on March 11, 1840, only 69° 54′.4375, or, as a mean, 69° 54′.8750. It is probable, from an experiment recorded in Major Long's expedition, making the dip at St. Louis, in 1819, 70° 30′, and, by my own observations, in 1839, making it, at the same place, only 69° 31′.4, the interval being twenty years, that the dip at this part of the earth is diminishing at the rate of about 3′ per annum. This will account for part of the change observed at Cincinnati. The remainder is probably produced by the seasons, which Hansteen allows to have an influence to the extent of 15′. Allowing 7′ for the annual diminution of the dip since November, 1837, we have for the change produced by the seasons,

$$70^{\circ} 25'.5312 + 7' + x = 70^{\circ} 45'.75$$
, and $x = 70^{\circ} 45'.75 - 70^{\circ} 25'.5312 - 7'$ or $x = 13' 288$ = the above named change.